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14-18, 21-27, 32-40, 43, 54-61, 64, and 76-84 under 35 U.S.C. § 103(a) as allegedly unpatentable over Japanese Patent Publication No. 11-080707 (Suzumura et al.) (hereinafter "the Suzumura '707 publication"). The Office Action also rejects claims 1-8, 11-29, 32-43, 54-64, and 76-86 under 35 U.S.C. § 103(a) as allegedly unpatentable over Japanese Patent Publication No. 11-080708 (Suzumura et al.) (hereinafter "the Suzumura '708 publication").

*Discussion of the Section 112, Second Paragraph, Rejection*

The Office Action rejects the pending claims as allegedly indefinite. In particular, the Office Action asserts that the alkaline earth metal concentration recited in the pending claims is unclear. Applicants respectfully traverse this rejection.

In numerous places, the present specification clearly indicates that the concentration units recited in the pending claims, namely "mmoles/kg," refers to the number of millimoles of the alkaline earth metal present in the polishing composition per kilogram of the polishing composition. As understood by those of ordinary skill in the art, a "millimole" is equal to one thousandth of a mole, which is the amount of a substance (e.g., an alkaline earth metal) that contains as many elementary entities (e.g., atoms) as there are atoms in 0.012 kilograms of carbon-12 (*IUPAC Compendium of Chemical Terminology*, 2<sup>nd</sup> Edition (1997)). The number of moles of an alkaline earth metal present in a particular polishing composition can be calculated by dividing the mass of alkaline earth metal present in the polishing composition by the atomic mass of the particular alkaline earth metal. Thus, in much the same way as calculating the molar concentration of a solution, one of ordinary skill in the art could routinely calculate the concentration of the alkaline earth metal present in the polishing composition in millimoles per kilogram ("mmoles/kg") using the mass of alkaline earth metal present in the polishing composition, the atomic mass of the particular alkaline earth metal, and the total mass of the polishing composition.

Therefore, contrary to the Office Action's assertions, one of ordinary skill in the art would readily appreciate the meaning of the concentration units recited in the pending claims and could calculate such concentration using methods that are known in the art. Accordingly, the pending claims are not indefinite, and the Section 112, second paragraph, rejection should be withdrawn.

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*Discussion of the Obviousness Rejections*

The Office Action rejects claims 1-8, 11-29, 32-43, 54-64, and 76-86 as allegedly unpatentable over the Suzumura '707 publication or the Suzumura '708 publication. Applicants respectfully traverse these rejections.

Neither the Suzumura '707 publication nor the Suzumura '708 publication discloses or suggests the specific combination of components recited in the pending claims, namely fumed silica particles, an alkaline earth metal selected from the group consisting of calcium, barium, and strontium, and about 0.1 to about 15 wt.% of an oxidizing agent, as recited in the pending claims. The Suzumura '707 publication is generally directed to a polishing composition comprising (1) water, (2) a polishing material, (3) at least one of carbonate ions, hydrogencarbonate ions, or carbonic acid, and (4) 0.001-0.15 mol/L of at least one cation selected from the group consisting of ammonium ions, alkali metallic ions, and alkaline earth metallic ions. The Suzumura '708 publication is similarly directed to a polishing composition comprising (1) water, (2) a polishing material, (3) at least one anion selected from the group consisting of nitrate, nitrite, chloride, perchlorate, chlorate, chlorite, hypochlorite, borate, perborate, sulfate, sulfite, persulfate, phosphate, phosphite, hypophosphite, silicate, organic acid radicals and ions of the hydroacids thereof, and (4) 0.001-0.15 mol/L of at least one cation selected from the group consisting of ammonium ions, alkali metallic ions, and alkaline earth metallic ions. The Suzumura publications further provide that the polishing material can be silicon dioxide, aluminum oxide, cerium oxide, titanium oxide, silicon nitride, zirconium dioxide, or manganese dioxide.

Neither of the Suzumura publications identify any of the components of the disclosed polishing compositions as comprising an oxidizing agent, as required by the pending claims, nor do the Suzumura publications suggest the use of an oxidizing agent in the disclosed polishing compositions. The Suzumura '707 publication discloses a polishing composition comprising carbonate ion, bicarbonate ion or carbonic acid. Contrary to the Examiner's assertion, one of ordinary skill in the art would not regard carbonate ion, bicarbonate ion or carbonic acid as oxidizing agents under typical conditions of chemical-mechanical polishing. Claim 1 of the Suzumura '708 publication recites a composition comprising an ion selected from group consisting of nitrate, nitrite, chloride, perchlorate, chlorate, chlorite, hypochlorite, borate, perborate, sulfate, sulfite, persulfate, phosphate, phosphite, hypophosphite, silicate, organic acid radicals and ions of the hydroacids thereof. The group of ions includes ions that are considered to be oxidizing agents (e.g., perchlorate, perborate,

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persulfate, and the like) as well as ions that are not considered to be oxidizing agents (e.g., silicate, phosphate, ions of organic acids, and the like). Further, the specification of the Suzumura '708 publication teaches a composition comprising ions of acids from a "laundry list" of acids including many acids that are not regarded by skilled artisans as oxidizing agents under typical conditions of chemical-mechanical polishing as well as acids that are regarded as oxidizing agents (see, e.g., paragraph [0025] of the computer translation of the Suzumura '708 publication available at the Japanese Patent Office web site). For example, carboxylic acids such as acetic acid, monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, maleic acid, fumaric acid, and the like, are not considered by those of ordinary skill in the art to be oxidizing agents under normal circumstances. There is no teaching or suggestion within the disclosures of the Suzumura publications to select an acid or ion thereof that acts as an oxidizing agent. Accordingly, neither of the Suzumura publications specifically teaches nor suggests the use of an oxidizing agent in polishing compositions as recited by the pending claims.

While the Suzumura publications do list both colloidal silica and fumed silica as suitable polishing materials, they do not teach or suggest that fumed silica is more desirable than or performs better than colloidal silica or any of the other polishing materials as set forth in the Suzumura publications. Indeed, as best can be understood from the Suzumura publications, fumed silica is merely listed as one of several suitable alternatives for use in the disclosed polishing composition. Thus, without more, one of ordinary skill in the art would not have been motivated to select and combine portions of the Suzumura '707 publication or the Suzumura '708 publication in such a way as to arrive at the invention defined by the pending claims. Therefore, the invention defined by the pending claims cannot properly be considered *prima facie* obvious over the Suzumura '707 publication or the Suzumura '708 publication.

Furthermore, assuming *arguendo* that the invention defined by the pending claims is *prima facie* obvious over the Suzumura '707 publication or the Suzumura '708 publication, the examples set forth in the present specification clearly demonstrate that the invention defined by the pending claims achieves an unexpected result. The Suzumura publications provide that cations suitable for use in the disclosed polishing compositions include NH<sub>4</sub><sup>+</sup>, Li<sup>+</sup>, Na<sup>+</sup>, K<sup>+</sup>, Be<sup>2+</sup>, Mg<sup>2+</sup>, and Ca<sup>2+</sup>. However, as demonstrated by Example 1 of the present application, a polishing composition comprising about 0.50 mmoles/kg of calcium exhibited a tantalum removal rate that was over 400% greater than the tantalum removal rate of a

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similar polishing composition comprising about 0.82 mmoles/kg of magnesium (see, e.g., Polishing Compositions 1A and 1D in Table 1 of the instant application). Insofar as the Suzumura publications appear to suggest that each of the aforementioned cations is equally suitable for used in the disclosed polishing compositions, one of ordinary skill in the art at the time of invention would not have expected such a dramatic difference in the tantalum removal rates exhibited by similar polishing compositions comprising calcium and magnesium.

In view of the foregoing, the obviousness rejection over the Suzumura '707 and '708 publications is improper and should be withdrawn.

*Conclusion*

The application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,



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